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AUTHOR Curtis, Jonathan
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ABSTRACT

Presented is a procedure that could be used by a school system to identify by the end of first grade those children who are likely to underachieve (achieve or overachieve) in reading by the third grade. The procedure consists of (1) Defining underachievers, achievers, and overachievers through use of regression and its standard error, (2) Obtaining the measurements to be used in constructing a discriminant model for predicting underachievers, achievers, and overachievers, (3) Constructing an "optimal" model through use of the stepwise discriminant procedure (BMDC7M), (4) Validating the model through use of an independent sample, (5) Using the model to make predictions, and (6) Updating the model periodically. For this study, an underachiever was a child who had not gained in reading at a rate comparable to others at his reading level. Table II identifies the predictor variables utilized by the discriminant model and the coefficients and constants which enable the model to discriminate among the groups of interest. It is pointed out that if one can identify potential underachievers, intervention programs may be designed to attempt to overcome the underachieving tendency. (CK)

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IDENTIFICATION OF POTENTIAL DISCREPANT ACHIEVERS WHEN SOMETHING CAN BE DONE ABOUT IT

Chicago, Illinois
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Presentor: Dr. Jonathan Curtis
Assistant Professor
New Mexico State University

The model I will discuss today was constructed from data of the Riverside School Study, Riverside, California.

I. What's the Study All About?

The study illustrates a procedure that could be used by a school system to identify by the end of first grade those children who are likely to underachieve (achieve or over-achieve) in reading by the third grade.

The procedure consists of:

1. Defining underachievers, achievers, and overachievers through use of regression and its standard error.
2. Obtaining the measurements to be used in constructing a discriminant model for predicting underachievers, achievers, and overachievers.
3. Constructing an "optimal"* model through use of the stepwise discriminant procedure (BMD07M).
4. Validating the model through use of an independent sample.
5. Using the model to make predictions.
6. Updating the model periodically.

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*The functions so identified are "optimal" in the sense that they provide the best prediction possible within the constraints of the stepwise procedure and the chosen level of risk.

II. What's an Underachiever?

There is, of course, no carefully defined agreement as to what constitutes an underachiever. However, for this study, an underachiever was a child who had not gained in reading at a rate comparable to others at his reading level. More accurately, an underachiever was an individual whose actual third grade reading score (regression of third grade reading scores on first grade scores) was less than one standard error below his predicted score. Figure 1 illustrates how underachievers, achievers and overachievers were defined.

III. What Technique was Used to Predict Underachievement?

The technique of discriminant analysis was developed many years ago by R. A. Fisher, although use of the stepwide procedure adds a modern twist.

IV. Well, What Does the Technique Do?

Given groups like heart attack victims and healthy individuals or any other groups naturally or artificially defined, the model will attempt to predict the group to which an individual belongs on the basis of predictor measures provided by the model builder. For example, weight, blood pressure, blood composition, state of anxiety, and amount of smoking may be good predictors for discriminating between heart attack victims and healthy individuals. Since certain conditions associated with heart attack victims may also be characteristic of individuals who are likely candidates for heart attack, the model constructed

to differentiate between heart attack victims and others may be useful in identifying those individuals prone to attack.

V. What Makes Heart Attack Victims and Underachievers in Reading Alike?

Nothing, except that the technique outlined for discriminating between potential heart attack victims and others can also be used to discriminate among potential underachievers, achievers, and overachievers.

VI. Why Not Illustrate With an Example?

Why not. Table II identifies the predictor variables utilized by the discriminant model and the coefficients and constants which enable the model to discriminate among the groups of interest. It can be seen that the "School Anxiety" and "Adjustment" measures differentiate mainly between underachievers and the others, while the Peabody Picture Vocabulary Test differentiates among all groups (underachievers, achievers, and overachievers). The relationships of the coefficients appear to indicate that among the groups of interest, the underachievers are the least anxious, least happy, and least language developed. While this might suggest some possible strategies to overcome the tendency to underachieve, it is imperative to remember that the models are constructed to differentiate among the groups of interest as a total model and not by individual variables. That is, the basic relationship among the coefficients for a given variable may change when another variable is entered into the model or a previously entered variable is removed. The

important implication is that one should tread very carefully in attempting to infer cause and effect relationships from model coefficients.

It may be of interest to note that the model illustrated in Table II was constructed from a field of eleven contending variables having the initial relative discriminative strengths presented in Table I. As can be seen, the Peabody measure provides by far the greatest discriminative strength of any of the variables considered. The other variables with stronger initial discriminative strengths than the "Adjustment" and "School Anxiety" measures do not appear in the model constructed because their discriminative strength when adjusted for their association with the Peabody measure was less than those variables completing the model.

VII. How Well Does the Model Work?

Table III illustrates both the success and the non-success of the model. The three numerals on the diagonal running from upper left to lower right represent the number of individuals correctly classified as overachievers, achievers, and underachievers respectively. All other numerals represent individuals incorrectly classified. For example, the information in Table III indicates two underachievers were classified as overachievers. Most importantly, the table suggests that 48% were classified correctly. Certainly one would prefer using a model that classifies more successfully. Nevertheless, prediction is

considerably above that expected from chance classification, as is indicated by the F value expressed in Table II. Furthermore, when the model was applied to an independent sample, its classification success was 47%, which, since the decrement in predictive power is small, suggests the model is generalizable to Riverside school children rather than being sample specific.

VIII. Can the Model be Improved?

The model constructed considered only eleven measures from practically an infinite field. While the measures represent quite a broad scope, there are many areas untouched (the teacher's perception of the child, parental attitudes toward education, home background, peer assessment, and many others). Thus, the possibility of improving the model is excellent.

IX. Should This Model be Used by Others?

No. Definitely not. The model was constructed and validated using data obtained from children representing the Riverside public schools. Thus it is unlikely to be applicable in other settings where demographic characteristics are different. Moreover, one would want to construct the best predictive model possible. To do this, a school system would need to construct a model of its own. Table I suggests some measures that should be considered in developing such a model. Additional measures with the potential for enhancing prediction should also be examined.

X. What Implications Does the Model Hold for Evaluation?

If one can identify potential underachievers, intervention programs may be designed to attempt to overcome the underachieving tendency. The success of such programs could be examined by randomly assigning half of the potential underachievers to the intervention program and the other half to the regular classroom schedule. When the interventions are complete, the proportions of individuals no longer classified as underachievers in each group could be compared. A significantly larger proportion in the intervention group would suggest the intervention programs were successful.

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TABLE I

RANK OF EACH MEASURE'S INITIAL DISCREPANT ACHIEVEMENT DISCRIMINATIVE STRENGTH (N=198)

Measure	Initial F Value (2,195 d.f.)	Rank
Peabody Picture Vocabulary Test	11.21	1
Lorge-Thorndike Intelligence Test	5.88	2
Raven's Colored Progressive Matrices	5.81	3
'Perceived Attitude of Others Toward Self'	4.65	4
'Adjustment' Instrument	4.13	5
'School Anxiety'	3.59	6
'Rod and Frame' Test	3.59	7
'Locus of Control'	1.68	8
'Self-Attitude'	1.04	9
'Desire for Mastery'	.97	10
Duncan's Socio-Economic Index	.19	11

*The heavy line separates the F values significant at the α = .05 level from the non-significant values.

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TABLE II
STEPWISE DISCRIMINANT MODEL
(N=198)

Variable	Overachiever Coefficients	Achiever Coefficients	Underachiever Coefficients	Means
'School Anxiety'	0.23	0.24	0.21	72.92
Adjustment (Happy-Sad Pictures)	0.58	0.59	0.50	24.18
Peabody	0.90	0.83	0.77	61.18
Constant	-45.41	-41.68	-34.45	

*Associated F value, F(6,386 d.f.) = 6.26.

TABLE III

DISCREPANT ACHIEVER CLASSIFICATION UTILIZING THE RESTRICTED STUDY SAMPLE STEPWISE DISCRIMINANT MODEL (STUDY SAMPLE)

Actual Classification	Classification by Model: O[a]	A[b]	U[c]	Total
O	21	11	4	36
A	42	49	34	125
U	2	9	26	37
Total	65	69	64	198

[a] O: Overachievers

[b] A: Achievers 48.48% (96/198) correctly classified

[c] U: Underachievers

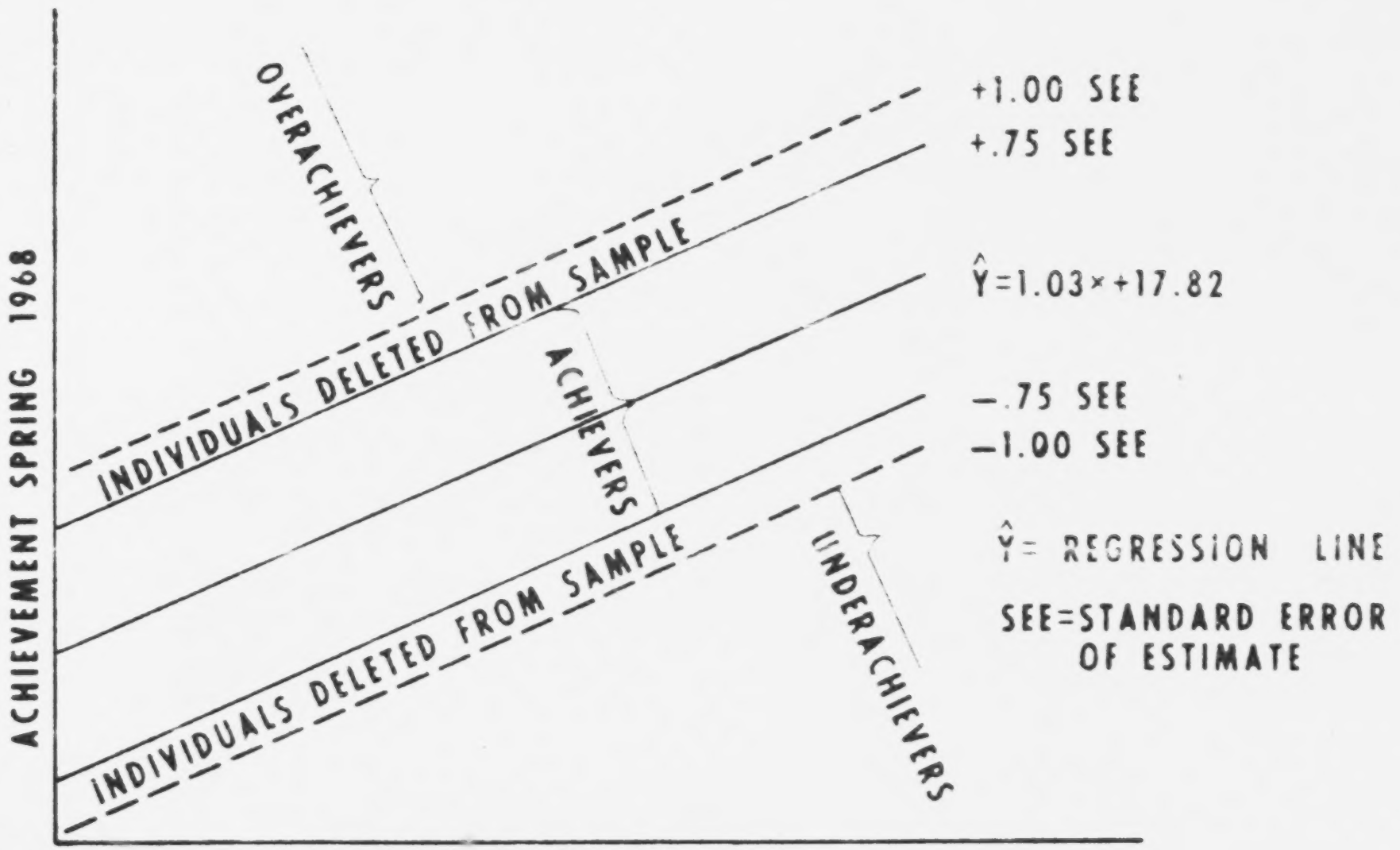

FIGURE 1

RESTRICTED SAMPLE OVERACHIEVER, ACHIEVER, AND UNDERACHIEVER DEFINITION WITH RESPECT TO REGRESSION AND THE STANDARD ERROR OF ESTIMATE